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Energy Procedia 16 (2012) 1225 – 1229

Energy Procedia

2012 International Conference on Future Energy, Environment, and Materials

The Research on Flood Character Grid Base on GIS

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Abstract

Flood character grid is the most important part of the spatial information grid, which is used in the research of the model for flood disaster loss assessment. The implement of it's processing including: (1)Create a polygon class which has elevation, the depth of flood, the speed of flood current, the pollution degree of flood field in Personal Geodatabase; (2)Determining the size of grid and set the size of polygon element according with its size;(3)Import the attribute value to correspond field;(4)Use ArcEngine and C# programming implement it. The application example results show that the speed of use personal Geodatabase to create polygon class is very fast and use the data of DEM can extract the elevation attribute effectively, it can provide the basic data for the loss assessment of the flood disaster consequently.

Keywords: Model for the loss assessment of the flood disaster; Grid; Flood character; Attribute

1. Introduction

According to the incomplete statistics, the direct economic losses caused by the flood disaster are up to the 10 billion Yuan in our country. Therefore, processing the loss assessment of the flood disaster is essential. At first we must determine the area of flood. The flood's border is irregular commonly; it doesn't coincide with administrative line. The flood may submerge some parts of village or town, whereas social and economic data is statistic by the administrative unit. In the administrative unit social and economic information distribution is uneven, if we use administrative units in losses statistical calculation directly, the flooded area of social and economic indicators calculation and the flood distribution characteristics will exist some unreasonable. In order to solve these problems, we can divide the area of

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 doi:10.1016/j.egypro.2012.01.195

flood into grids. This kind of grid is different from commonly significance grid. It bases on GIS and includes spatial topological relation and attributes information. It gathers the social economy and the flood character information. It has elevation property and can be composed of the triangle rules and irregular quadrilateral and freeform quadrilateral.

Spatial Information Grid is a kind of massive spatial information resources, which can collect and share in geographical distribution. It is an innovative system framework, can provide practical and feasible solution thread and implementation scheme for spatial information user processes obtain, sharing, accessing, analyzing and manage and so on requirements on spatial data.

Documentation [1] considers Spatial Information Grid of model for the loss assessment of the flood disaster is made up of flood character grid and spatial distribution social-economic gird. The author considers building accurate flood character grid is premise of processing precision the loss assessment of the flood disaster. So that the author apples the technology of GIS to make flood character grid.

2. The Compose of Flood Character Grid

Flood character grids mainly include the divide method of grid and attribute. Choose the appropriate divide method of grid and attribute is premise of processing precision the loss assessment of the flood disaster.

2.1. The Divide of Flood Character Grid

Owing to the area of flood is irregular, consider the convenience of study, we build an envelope for the area of flood as the whole extent of flood character grid，thereby processing the division of grid. The division of grid main includes regular quadrilateral, irregular triangle and irregular polygon and so on [2]. Due to the area of flood is very large, apply irregular division of grid will make the speed of calculation slow. Consider the factor of the speed of calculation and convenience; we apply regular quadrilateral division to divide the flood character grid. Due to the size of grid is direct related to the accuracy of Assessment and the size of grid is not decided by random. The size of grid is closely related with the size of spatial data which apply in disaster calculation such as the data of land utilization, DEM. The size of grid should bigger than the size of corresponding spatial data or equal to it, otherwise smaller the grid is vain also [3]. The spatial data of this paper adopt the raster of DEM, so that the size of grid equal to the size of raster.

2.2. The Attribute of Flood Character Grid

The loss economy of the flood disaster is closely related with the degree of the flood. Generally speaking the depth of the flood is more deeper, the time of the submerge is more longer, the speed of the current of the flood is more faster, the sediment concentration of the flood is more large, the density of the pollution is more large, corresponding the loss of the flood disaster is more larger [4]. The degree of the flood is decided by the depth of the flood, the time of submerge, the speed of the current of the flood, the sediment concentration of the flood and the degree of the pollution. Choose reasonable attribute to process assessment is basic of processing precision the loss assessment of the flood disaster. There are many attributes effect the loss assessment of the flood disaster, we can select attributes according to the actual situation. This paper choose elevation, the depth of flood, the speed of the current and the degree of the pollution as the attributes of flood character grid.

3. The Implementation Thread of Flood Character Grid Base on GIS

For meeting various spatial analyses, that we make flood character grid. The result of flood character grid should be a layer of polygon class which has the fields of elevation, the depth of flood, the speed of the current and the degree of the pollution. The implementation thread of flood character grid base on GIS shows as follows:

- (1)Create a polygon class which has the fields of elevation, the depth of flood, the speed of the current and the degree of the pollution in workspace. There are three kinds of workspaces in ArcEngine such as EsriFileSystemWorkspace, EsriLocalDatabaseWorkspace and EsriRemoteDatabaseWorkspace. The test result show that EsriRemoteDatabaseWorkspace is not suit to this case and the speed of create a polygon class in EsriLocalDatabaseWorkspace is more faster than esriFileSystemWorkspace, so we choose EsriLocalDatabaseWorkspace. The esriLocalDatabaseWorkspace main include File Geodatabase and Personal Geodatabase. We can choose reasonable type according to the actual situation. In this paper we choose Personal Geodatabase.
- (2)Due to the size of grid should bigger than the size of corresponding spatial data or equal to it, so that the size of every polygon element in polygon class should bigger than the size of corresponding spatial data or equal to it. In this paper we choose the case of equal to it.
- (3)At last we import attributes to corresponding fields. In this paper we import elevation value to elevation field as example.

4. The Implementation of Flood Character Grid

According to the thread mentioned above，we use ArcEngine and C# programming implement it. The steps show as follows:

- The code of create polygon class which has corresponding fields in Personal Geodatabase.

```
 {
IGeometryDef  //define geometry type
IField       //define and add field
IFeatureWorkspace. CreateFeatureClass() //create polygon class
 }
```

- Extract the envelope of the area of flood and define the size of grid, at last save every grid from left to right and from the top to down as polygon element and add in polygon class mentioned above.
  The code show as follow:

```
 {  IEnvelope         //Extract the envelope of the area of flood
Int row;int column //the count of row and line of the area of flood
IPointCollection   //define four corner of every grid
IPolygon          //define polygon
//convert very grid to polygon
   for (int i = 0; i <= row-1; i++)
{ for (int j = 0; j <= column-1; j++)
     { IPointCollection as IPolygon;
     } }}
```

- Import the raster of DEM's elevation value to elevation field as example.
  The code show as follow:

```
 {IRaster2. GetPixelValue(0, column, row)//obtain the raster of DEM's elevation
    WorkspaceEdit. StartEditOperation();//start editing
    //import elevation value from left to right and from the top to down
```

```
    for (int i = 0; i < clipRowCount;i++ )
   { for (int j = 0; j < clipColumnCount;j++ )
      { IRow pRow = pTable. GetRow(k);
        pRow. SetValue();}}
WorkspaceEdit. StoptEditOperation();//close editing}
```

5. Application Example and Conclusion

We take a name of DEM raster data as the data resource which is extracted elevation attribute and take a name of FloodExtent which is a layer of polyline as the area of flood. We use the program mentioned above to make the flood character grid.

5.1. Make the Flood Character Grid

- Add DEM raster data and FloodExtent polyline data, extract the envelope of the area of flood then according to the size of raster, convert every grid to polygon element. The operation result show as Fig.1:

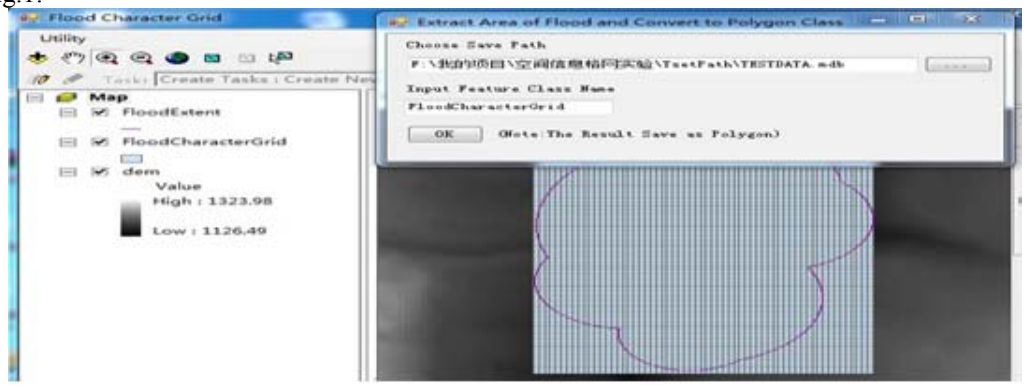

Fig. 1. the result of extract and convert

- Open the attribute table of layer which name is FloodCharacterGrid, we can see that it's every fields is empty except the field of length and area which create automatic. Show as Fig. 2:

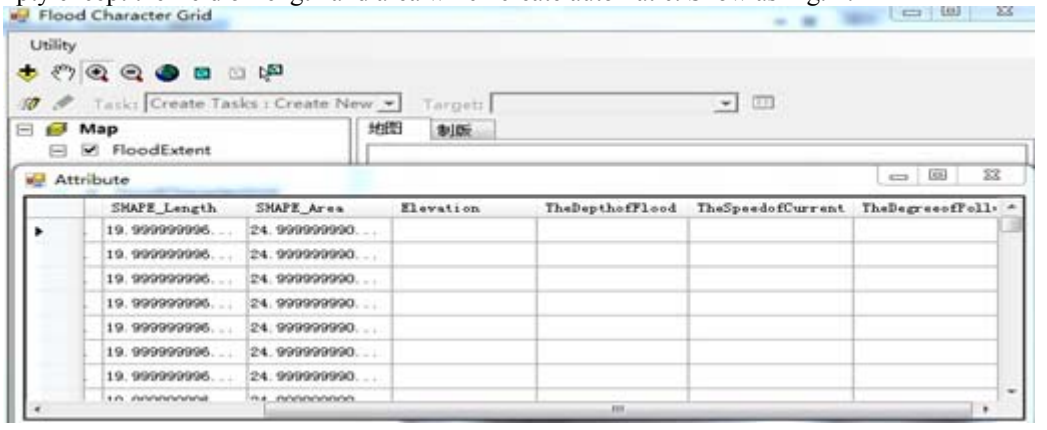

Fig. 2. the result of attribute table

- Import the elevation value of DEM raster data to elevation field.
- Right click the key of mouse then click import attribute, the result show as Fig. 3:

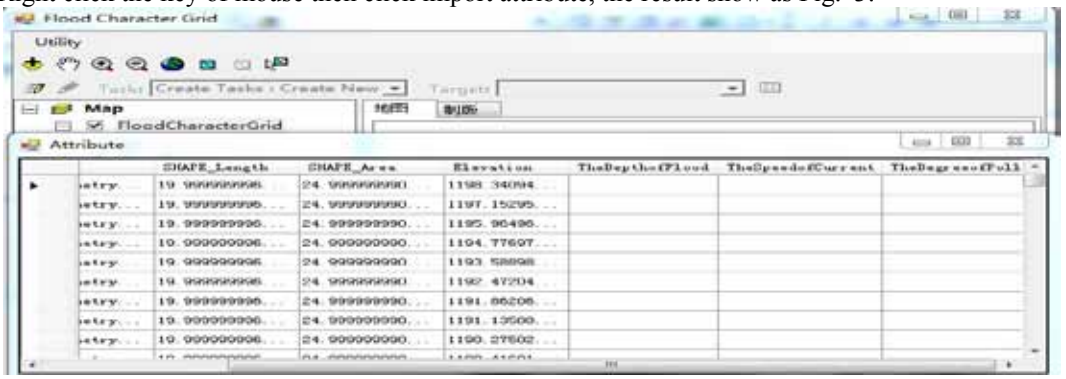

Fig.3. the result of import attributes

5.2. Conclusions

The result of application example show that after import attribute, the FloodCharacterGrid polygon class is the flood character grid. Through use flood character grid, we can use it as basic data process overlay analyses with spatial distribution social-economic gird，the analyses results obtain their attributes so that we can process the loss assessment of the flood disaster. From the process of making flood character grid, we not difficult to find the advantage of making grid base on GIS technology:(1) Choose the Personal Geodatabase because of the speed of create FloodCharacterGrid is very fast;(2) Merge the extraction of the area of flood, define the size of grid and convert every grid to polygon element together that make operation easy;(3)Save as polygon class that make it process various spatial analyse convenient.

Acknowledgements

The project is supported by National Natural Science Foundation of China (Grant No. 41061041) and Natural Science Foundation of Jiangxi Province, China (Grant No. 2010gzs0084).

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